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# PAPERS READ

## BEFORE THE

# ROYAL GEOGRAPHICAL SOCIETY.

## I.—*Remarks upon the Country between the Caspian and Black Seas.* By Professor H. Abich.

Communicated by Sir Roderick I. Murchison.
[Read Jan. 13, 1851.]

The extraordinary diversities of climate that occur in the countries situate between the Euxine and Caspian seas depend so much on their geological and orological configuration, that before entering upon that subject, it seems indepensable to lay before the Society a general account of these countries, in which I have been officially employed during several years as an exploring geologist.

From observations made by Mr. Tchihatchef during the winter of 1829, it appears that in the low steppes between the Caspian and the sea of Aral, the mercury in his thermometer sunk nearly as low as the freezing point.

The Caucasian chain, rising like an island from a low plain almost as level as the sea, forms a continuous barrier between two sea-basins occupying each an area of from 14,000 to 15,000 square leagues.

The counterscarp on the N. is formed by a gently sloping glacis, often richly wooded, and terminating in abrupt and perpendicular cliffs from 2000 to 4000 feet high. It comprehends various geological formations, beginning at the youngest tertiary, and ranging through chalk, green sand, and oolite. In the north-western half of this chain we find granite, gneiss, and crystalline slates, traversed by dykes of diorit, Labrador porphyry, and melaphyr; in the south-eastern, principally slate, rising occasionally into rugged peaks to a height of 15,000 English feet above the sea. In latitude 61° 30′ (or 43° 50′, reckoned from Greenwich) is the mountain mass called Conguti Chock, which abounds in metallic lodes; here the central chain affords a series of long elliptical valleys, bounded by huge rocky walls, except where the rivers Naridon, Terek, Assa, Argun, and Sulak * have forced for

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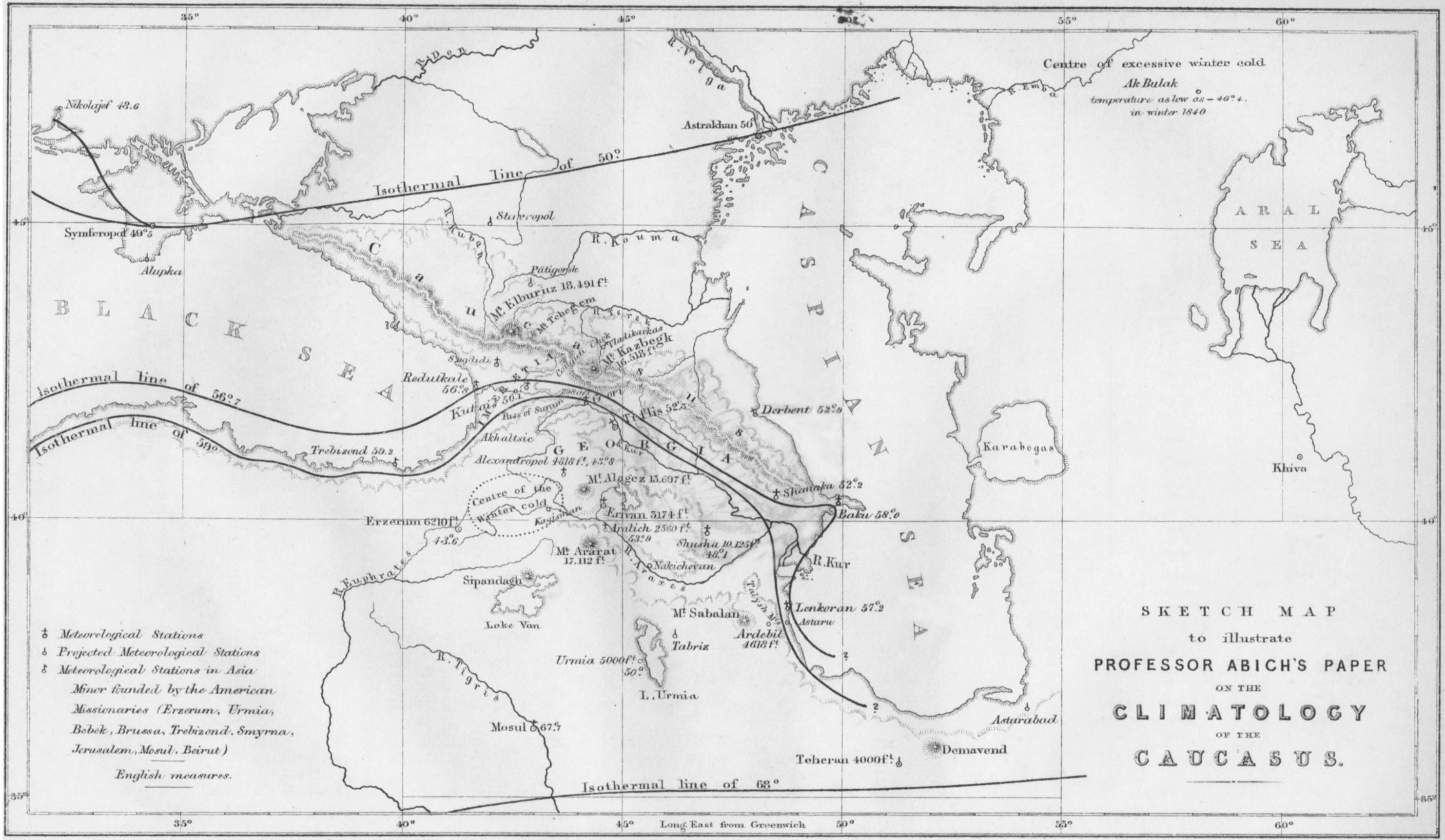
* In Koch's map of the Caucasus, the Dundut, Uruch, Tscherek, Psergamussu, Smeika and Urssdon, Ardon, Fiagdon, Absek, and Assai; several of which flow into the Terek.—Ed.



- ♁ Meteorological Stations
- ♁ Projected Meteorological Stations
- ♁ Meteorological Stations in Asia Minor founded by the American Missionaries (Erzerum, Urmia, Bebek, Brussa, Trebizond, Smyrna, Jerusalem, Mosul, Beirut)

English measures.

SKETCH MAP
to illustrate
PROFESSOR ABICH'S PAPER
ON THE
CLIMATOLOGY
OF THE
CAUCASUS.

Published for the Journal of the Royal Geographical Society by John Murray London 1851.

Engraved on stone by A. Petermann 5 Camden St. (N.)

themselves an exit northwards. Of this phenomenon, so important both in a geological and ethnological point of view, I have given a detailed description in Vol. VII. of the Bulletin of the Academy of St. Petersburgh—it is strictly analogous to what takes places in the Andes.

In the tract that intervenes between the central chain and the counterscarp occur three great volcanic regions, each independent of the others. Their names, as we proceed from S.E. to N.W., are, 1, Kasbegk ; 2, Tchegem ; 3, Elbouruz. The high secondary ridge above mentioned on the N. of the chain is intersected by several deep transversal gorges, and presents a number of bastions ; the highest of these, the famous Schachdag, which is of dolomit, abounds in ostrea macroptera, terebratula depressa, and ammonites. It attains the height of 13,800 feet, and is covered by perpetual ice and snow.

The shape of this mountain is referable to two great parallel faults, the one ranging from N.W. to S.E. ; the other from E. to W., slightly affected here and there by a third, running in the direction of N.E. and S.W.

Such is the structure of Caucasus on the N.

On the S. the slope is very irregular, extending over the flatter and undulating region of Georgia Proper, the orological relations of which are still regulated by the three faults above mentioned. The dislocating and upheaving forces have here produced great variety in the rocks. Amygdaloidal beds of peculiar character were here thrown up at the same time that the fossiliferous beds on the N. of the Caucasus were deposited apparently in a tranquil sea.

The hydrographical communication of the Euxine and Caspian on the S. of the Caucasus is interrupted by an elliptical patch of granite, which, stretching in a direction from N.E. to S.W., interferes towards the S. with an extensive group of mountain land, which runs W. and E., following the course of one of the great faults. This granitic ridge, by Strabo denominated the knee of Caucasus, is often intersected by erupted rocks, and overlapped by different sedimentary formations, ranging from the upper oolitic to the miocene. Here is the native country of the Meskè or Moskè of the ancients ; it divides Colchis from Iberia, the woody and marshy flats of the Phasis from the flat dry valley of the Cyrus, or Kur. Though at the pass of Suram its absolute height does not exceed 2980 feet, it has an extraordinary effect upon climate. By the junction of the Meske ridge with the lateral chains of Trialethi and Somsethi, which separate the pachalics of Achalzic and Imeritia, the Caucasian mountains are brought into immediate connection with the elevated volcanic tract of the sources of the

Cyrus and Araxes, viz. the highland of Ardahan, and the culminating ridge of the Taurus, S. of Erzeroum, on the W.; and on the E. with the bifurcating chains of the Pambak and the metalliferous ranges of Armenia, which, separating the Araxes and Cyrus, take, like the Caucasus, a south-eastern direction. For this reason probably the old Armenian geographers gave to the whole of these chains the appellation of Lower Caucasus, which, however, is geologically very different from the upper.

A vast series of palæozoic limestones, Devonian slate, and carboniferous limestones (of all which not a trace has yet been discovered on the Caucasus), forms the basis of an extensive range of highland, which, varying in altitude from 2560 to 4800 and 6400 feet, stretches westward into Asia Minor, and south-eastward into Persia. The palæozoic beds, on the contrary, in whatever position they may be found, whether horizontal, or inclined, or contorted, trend uniformly to the N.E. This highland, which in the chain of Karabagh* attains a height of 12,250 and 12,800 feet, is bordered or traversed by systems of parallel subordinate mountain chains, which conform always to one or other of the abovementioned axes of dislocation. The rocks composing it are proved by their fossil contents to belong to various formations, including the Devonian and carboniferous groups, the cretaceous, and nummulitic, but they received their actual trend from the intrusion of crystalline rocks at a relatively recent period. It was volcanic agency, however, in its most energetic development, which, at a still later period, gave to these highland regions their peculiar feature, and stamped upon them those remarkable physical characters by which they differ essentially from the Upper Caucasus.

In the Upper Caucasus the volcanic heights of Kasbegk and Elburuz, 16,520 and 18,475 feet, appear as lofty peaks in the midst of the mountain range, having forced their way through a wildly-broken surface presenting a succession of abrupt ridges and deep valleys.

On the Armenian highland, or Lower Caucasus, where the surface is more uniform, we find, on the contrary, large isolated domes, low cones, with rounded edges and gentle declivities; we find numerous craters, from which have issued enormous streams of lava, which, descending into the valleys, have filled them up to the height sometimes of 300 or 400 feet, and this to the extent of more than 15 miles. All these volcanic hummocks are referable to two parallel lines of disturbance, that traverse the whole country in the same direction as the Caucasian range, viz.

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* The Dalydag, composed of trachytic porphyry, 11,690; the tops of the Tuchtikan 11,800, on the N.E., of quartzose porphyry; and the Kapulchigdag, 12,840, fifty wersts from Nachitschevan, in the south-eastern range of the Karabagh Mountains.

from N.W. to S.E. The upper one commences northwards, in the midst of the trachitic domes and cones, from 9,000 to 10,000 feet high, on the W. of Achalzic,* which has been famous from the earliest period for the intense cold of its winter season. On the S.E. it reaches the Sabalan, near Ardebil, the height of which probably exceeds 15,000 feet, and further on the Demavend, N. of Teheran, 15,000 feet. Throughout the whole range, of about 470 geographical miles in length, we find an almost uninterrupted line of great volcanic vents, which have, at some time or other, filled up the pre-existing valleys, so as to change them into shallow basins, or to create lakes, by barring up the outlets of the waters that traversed them. Over extensive areas the older rocks are covered by flat-vaulted, volcanic platforms of 8000 to 9000 feet mean elevation, traversed by conical craters; the highest of these are the doloritic under cone of Agmangan, 12,800 feet high, the huge obsidian and pumice cone of Agdag, 12,300, and the flat dome of Alagez, 13,063 feet. The second volcanic parallel is situate in the north-western prolongation of a line drawn through the two summits of the Ararat (17,500 and 13,123 feet high) to the peak of Koezedag. It comprehends the Parlydag on the great Sinak, remarkable for the beauty of its outline, and attaining the height of 10,600 feet.

The interval between those two parallel series of volcanic heights is occupied by the famous plain of Araxes, a long, wide, and flat basin of 2560 feet mean absolute elevation, surrounding the foot of Ararat, where the eye, carried along the outline of the encircling mountains, meets a gentle slope; steep declivities occurring only where the volcanic formation is interrupted by out-cropping sedimentary or plutonic rocks. These short outlines of the Caucasian geography will render it sufficiently obvious that every meteorological agent will, in these regions, exert a variously modified influence, giving rise to a great number of like climatological conditions.

To this statement a graphical expression is given by the lines of perpetual snow. The highest point at which snow disappears in summer on the Upper Caucasus is 12,040 feet on the Schagdag,† but 10,980 on Elburuz. In the Lower Caucasus this point exceeds even 13,900 feet on Ararat. Hence it appears that the whole mountain region of the Lower Caucasus, with the exception of Ararat and Alagez, loses its snow in summer, and the difference between the utmost limit of the snow line in the

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* Pozchonday, Dochus-ponar, Tilil 820, Ytchtapatar 9786, Elikli 10,020 feet.

† On the top of Tschalbuzdag, which is the second height of the cistern called Schagdag, I met only with dispersed patches of snow at an absolute elevation of 12,050 feet.

Upper and the Lower Caucasus may be estimated at from 1600 to 1900 feet.

As I can merely offer a brief sketch in this communication, I shall confine myself to pointing out a few of the chief peculiarities of our Georgian climate which are of general interest, and relate to some questions of physiological importance to the inhabitants, prefacing the subject by some explanatory remarks with reference to the Table I.

A system of meteorological observations, established, under the direction of Prince Woronzof, by myself on both sides of the Caucasus, from the shores of the Black Sea to those of the Caspian, in connection with the central magnetical and meteorological observatory in Tiflis, has for several years furnished complete series of contemporaneous observations, made with good instruments, and carefully compared between each other. The chief results of two years observations have been calculated for 12 places in Georgia.

These observations have shown that the isothermal zone of 57° and 59°, after having traversed the land between the Caspian and the Black seas, is inflected abruptly to the S., when it reaches the Caspian. Hence it results that the annual temperature at Redutkale, on the Black Sea, of 37°. 5, is found again in Lenkoran, 3° more to the S., and the temperature, 58° of Kutais, occurs again in Baku.

The mean annual temperature of Tiflis, of which the elevation is 1385 feet above the level of the sea, is reduced to 55°. 4.* Tiflis is included in the above mentioned isothermal zone between 57° and 59° (Table I.).

In connection with this equality in the mean annual temperatures, there is now an extraordinary discrepancy between the mean temperatures of the seasons in the before mentioned places.

This unequal distribution of absolute temperature imparts to the climate of Georgia that particular character of astonishing variety, which is the principal source of the riches of the soil.

The winters in Lenkoran are proportionally colder than those of Kutais and Redut, and in the year 1848 this difference was tripled; but the summer and harvest-time are warmer in Lenkoran and Baku than in Redut and Kutais. With reference to the cold of the winters in Lenkoran, I may state that the self-registering thermometer indicated there, during a fortnight in January, a series of minima, of which the mean was 22°, but the extremes were 11° and 13°. In the very extreme winter of 1844 to 1845, the space between the isle of Sari and the shore of Lenkoran, 2 English miles wide, was covered with ice thick enough to allow a communication for walkers between the shore and the isle. For two months sledges were used in Lenkoran. The water-fowl migrated to Astaru, 10 miles to the S., where the air was milder. At the same time the self-registering thermometer at Erivan marked, in the course of one week thrice, −24°. 2, in the same place where, 4 months later, in May, I observed 98°. 1 in the shade; the vapour dissolved in the air being only 18 per cent. The greater part of the famous trees of Juglans regia, aged more than 18 years, perished in the fruit-gardens of Kagismann on the Araxes, 4370 feet high; but the forest-like shrubs of laurus nobilis, in the neighbourhood of Kutais, in Imeretia, remained uninjured during the same winter.

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* 52°·9 in Map.—ED.

When the culture of the sugar-cane, which is frequent between Astrabad and Masenderan, was tried near Lenkoran, it was not suspected that that place, situated under the same parallel as Palermo and Smyrna, with their annual warmth of 61° to 63°, had only the annual and summer temperature of Montpellier, and often the winter temperature of Trier and Maestricht. (Table IV.)

It is this irregularity in the distribution of annual temperature, effected by the overpowering influence of the continental air, which determines the strange character of that vegetation, which covers the mountains of Talysch and the plains stretching at their bases. The principal kinds of shrubs and of evergreen trees, which give a peculiar charm to the forests of Imeretia and Mingrelia—the rhododendrons, the lauro-cerasus, the azalias, the jasmins—shun the cold and snowy winters of the upper Talysch and the shores of Lenkoran. The strong summer heat and the excessive moisture of those regions, produce and protect that celebrated summer vegetation, consisting of plants which are only annual, and which die every year after having borne their seeds.

The quantity of water produced by snow and rain in Lenkoran varied in two years between 52 and 40 inches; the mean annual quantity of vapour diffused in the air remaining nearly constant 82 per cent. A climatological comparison between Lenkoran and Baku, 2° further to the N., presents us with the interesting fact, that the moisture of the air being there nearly equal to that of Lenkoran, the summer is warmer and the winter is regularly milder, but the quantity of water furnished by the atmosphere is five times less than at Baku.*

These facts result evidently from the following circumstances: the nearly insular position of Baku, the vicinity of the great hot and dry plain of the Kur, whose insolation is favoured by an almost clear sky; the great capacity of that hot air for containing vapour, the predominance of a strong and little interrupted wind blowing from the leaside, and particularly the distance of high mountain chains, and the absence of wooded hills, capable of exercising an energetic influence upon condensation. The zone of frequent rains terminates on the southern border of the great Kur-plains, where the most remote undulations of the Talysch chain cease to be wooded, whilst the frequent traces of a former considerable cultivation on the famous steppe of Muganly, between the Araxes and Kur, betray the unfavourable change the climate of those regions has undergone in historical times by the destruction of woods, caused by the nomadic tribes, who have from the earliest times disputed those wide and fertile pasture-grounds.

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* Taking the total quantity of rain fallen in the year 1849 at Baku, and considering it as unity, we have the following proportions:—rain and snow fallen at Alexandropol, 2·23; Derbent, 2·50; Lenkoran, 5·11; Kutais, 6·85; Redutkale, 7·36.

By conditions like these the Caspian part of Georgia is now made to furnish an extraordinary contrast with the wooded and humid plains of Imeretia and Mingrelia, and the notable difference of agriculture and industrial development between those regions is the result of a physical necessity. It is the powerful action of predominating warm westerly sea-winds; it is the north-western direction of the Caucasian chain, and its increasing size and height within the meridian of Elbouruz, together with the relative position of the chain of the Meskian mountains, mentioned before, which protect the deeply enclosed Colchis against the aggression of the easterly extremes of cold, so far that high-stemmed citron and orange-trees at six hours westerly distance from Poti are to be found in beautiful luxuriance sheltered by insignificant wooded hills against the northerly winds, called in that land the winds of Suanetia.

The mean annual quantity of moisture of the air (or the relative humidity) is found in Redutkale 75 per cent. During the winter the wind changes, and, becoming a land-wind, the air is much drier. There is no place in Georgia where rain and snow produce a greater quantity of water than in Kutais and Redutkale. In 1849 these quantities were 52 and 66 inches, only half of that which is annually observed in certain places in the N.W. of England.

From the foregoing observations we may assume that the five places just described represent the climatological type of the two great physical divisions of the lowlands on the S. of Caucasus from one sea-basin to the other—divisions which Nature herself has established by erecting the wooded heights of Suram 3050 feet, Laooni 6180, and Pyranga 5220, as a natural barrier which divides the climates in an extraordinary manner. Towards the W. we observe the distinct influence of southern Europe, namely, the climate of isles and western shores with mild winters and temperate summers; towards the E. that of continental Asia, with severe winters and hot summers.

The Karthalinian country, represented by Tiflis, occupies a very important intermediate position on the eastern slope of the climatological barrier just mentioned, for there is no other region in Georgia where the opposed influences from the W. and the E. tend to neutralize each other in a more favourable manner. Besides, in Tiflis, from its more inland position, the increasing influence of the continental air is still sensible. Hence the difference between the summer and the winter temperature in Tiflis; Baku and Lenkoran is the same, and equals that in Petersburg and Abo; whilst that of Kutais and Redut is like that in western Germany (Table II.). The mean winter temperature in Tiflis is 34° 4′; that of summer, 74° 5′. The mean annual humidity of the air is 67 per cent., and the quantities of snow and rain amount only from 14 to 16 inches.

When we approach the high lands of the Armenian mountains, the continental character of the Georgian climate, as marked by extremes, is found to increase in a very rapid manner; the remarkable climatological character of the country, of which Ararat forms the centre, is now, for the first time, demonstrated by exact and comparative observations, made at the foot of Ararat, in Aralish, in Erivan, and Alexandropol, and cleared from the obscurity of previous erroneous valuations (Table III.). It is a fact of importance, in explaining the admirable physical economy of Armenian nature, that we meet with the summer temperature of Messina, of Baku, and of St. Croix on Teneriffe, at the foot of Ararat at the absolute elevation of 2560 feet, and recognize the winter temperature of the North Cape here in 24°, where at a height of 4160 feet the old and celebrated vineyards of the unfortunate Arguri were destroyed in the year 1840, not by the extreme cold of winter, but by a formidable natural phenomenon. It is no less unexpected to find Alexandropol, by the range of its temperature in different seasons, brought into the closest analogy with the St. Lawrence in Northern America.

| SEASONS. | ST. LAWRENCE. Lat. 44° 40′, Long. 77° 23′. W. | TORONTO. Lat. 43° 40′. Long. 79° 22′. W. | ALEXANDROPOL. Lat. 40° 47′. |
|---|---|---|---|
| Winter . . | 19·60 | 25·43 | 20·30 |
| Summer . . | 65·99 | 64·63 | 66·02 |
| Spring . . | 42·17 | 42·34 | 42·80 |
| Autumn . . | 45·20 | 46·81 | 47·12 |
| Year . . | 43·20 | 44·81 | 43·83 |

The excessive winter temperature of Alexandropol, lat. 20° 3′, which is that of Eyafiordar, in Iceland (latitude of 65° 40′), is explained by the peculiar position of that town, elevated 4980 feet, in the centre of those extensive Armenian highlands covered with numbers of flat dome-shaped elevations of volcanic origin, of 110 to 130 English miles in circumference, and of the absolute height of 11,000 to 13,000 feet; a region which, very early in the year, changes from grass-covered, alpine mountains, intersected by cultivated plains like valleys, into one immense undulating snowfield, stretching itself far beyond Erzerum into Asia Minor. It is the seat of excessive winterly cold, like that on the depressed easterly steppes between the Caspian and the sea of Aral, where Mr. de Tchihatchef observed—31° Fahr. in the winter of 1840.

In relation to the intensity of winterly cold we find another peculiarity of the steppes recurring on the plains of the Armenian highlands in the great dryness of the air. The greatest dryness of the atmosphere anywhere tested by hygrometrical observations was found by Humboldt, in the Asiatic steppes of Glatoffskaya, to be 16 per cent. This hygrometric state of the air I have in my numerous excursions over Armenia found to be a very frequent one, but I never observed a greater relative dryness than 17 per cent. in the neighbourhood of Ararat.

The intensity of the evaporating power of the air there is so strong, that I have, in the hottest period of the day, often observed differences between the dry and wet thermometer of 22° to 27°, and sometimes even 29° Fahr. in the shade. This evaporating power of the dry air is a physical circumstance of far greater importance to human health than I could ever have believed before a long course of practical experiments, obtained by constant comparison of the dry and wet thermometers in regions of very dangerous climatological conditions, taught me this practical truth, that the human body, being fairly comparable to a sensitive hygrometric instrument, it is much more important to know the amount of the loss of caloric by evaporation indicated by the wet thermometer, than the equivocal observations of temperature made with the common dry thermometer.

The currents of cool air from the high mountain regions towards the plains being the strongest when the insolation of the latter reaches its maximum, the evaporating process is materially accelerated, and is most intense on the inferior slopes of the mountains during the afternoon. Taking the total amount of all the winds in each month at 1000, the relative frequency of the winds in the summer of 1849 was at Erivan as follows:—

| Months. | Predominating Wind. | Relation between W. and E. | Hours of the greatest Dryness of the Air. | | | |
|---|---|---|---|---|---|---|
| | | | Hours. | Dry Thermometer. | Wet Thermometer. | Mean Relative Humidity. |
| January . . | N.E. = 468 | W. : E. = 1 : 3·2 | Hora 4 = | 76·9 | 55·22 | 0·39 p.c. |
| July . . . | N.E. = 673 | W. : E. = 1 : 8·8 | Hora 6 = | 82·7 | 58·35 | 0·37 |
| August . . | N.E. = 486 | W. : E. = 1 : 3·5 | Hora 2 = | 86·2 | 62·00 | 0·41 |

Every one, but especially the foreigner from the N., by incautiously exposing himself with too light clothing, particularly during perspiration, to the action of these refrigerating processes, much as they may be disguised by the hot temperature of the ambient air, is always in imminent danger of contracting a burning nervous or bilious fever of rapid and deadly course. I witnessed so many sad proofs of this, that I am convinced that it is rather the rule than the exception. The best mode of recognizing these meteorological conditions is to observe the difference between the dry and wet thermometer, and the surest method of avoiding their dangerous influence is to have a sufficient addition of clothes at hand, and carefully to apply it, so as to prevent the intense and accelerated loss of caloric which the cutaneous system would undergo by evaporation. Being convinced that it was by attention to these practical rules, which I was taught by the continued observation of the psychronometer during my travels of many years in a land of the greatest climatological discrepancies, that I must attribute my having always escaped the pernicious influence of the climate to which I was frequently exposed, it seemed to me a matter of duty to submit my own experience to the attention of those who are visiting other foreign continental regions, in which the daily differences between the dry and wet thermometer will present them with contrasts similar to those which occur in the Armenian highlands.

When more frequent use of the psychronometer shall have furnished us with a greater number of hygrometrical observations made in the higher regions than we now possess, they will be found of great value for comparative climatological and more minute physiological inquiries regarding the connection between our atmosphere and the development of organic life.

## Table I.

| Seasons. | Redutkale. Lat. 42° 16′. | | | | Kutais. Lat. 42° 13′. | | | | Tiflis. Lat. 41° 42′. | | | | Baku. Lat. 40° 22′. | | | | Lenkoran. Lat. 38° 44′. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1848. | | | | 1848. | | | | 1848. | | | | 1848. | | | | 1848. | | | |
| | Temperature of the Air. | Humidity Absolute. | Humidity Relative. | Rain and Snow. | Temperature of the Air. | Humidity Absolute. | Humidity Relative. | Rain and Snow. | Temperature of the Air. | Humidity Absolute. | Humidity Relative. | Rain and Snow. | Temperature of the Air. | Humidity Absolute. | Humidity Relative. | Rain and Snow. | Temperature of the Air. | Humidity Absolute. | Humidity Relative. | Rain and Snow. |
| Winter . . | 41·04 | 1·43 | 0·61 | . . | 39·49 | 0· | 0· | 22·872 | 32·13 | 1·40 | 0·79 | 0·800 | 36·45 | 1·85 | 0·38 | 6·805 | 34·36 | 1·82 | 0·88 | 15·652 |
| Spring . . | 54·38 | 3·32 | 0·78 | . . | 57·06 | 0· | 0· | 11·412 | 55·44 | 2·79 | 0·64 | 7·736 | 54·41 | 3·38 | 0·79 | 0·640 | 55·62 | 3·92 | 0·86 | 8·954 |
| Summer . | 73·42 | 6·39 | 0·81 | 14·588 | 74·86 | 0· | 0· | 12·164 | 75·67 | 4·64 | 0·58 | 4·205 | 77·99 | 7·32 | 0·80 | 0·650 | 76·91 | 6·51 | 0·74 | 6·216 |
| Harvest . . | 60·95 | 4·10 | 0·78 | 11·087 | 60·98 | 0· | 0· | 14·355 | 58·10 | 3·26 | 0·69 | 1·475 | 63·52 | 4·64 | 0·79 | 3·450 | 62·17 | 4·63 | 0·84 | 21·584 |
| Mean . | 57·22 | 3·81 | 0·74 | . . | 58·60 | . . | . . | 60·123 | 55·02 | 3·02 | 0·67 | 14·216 | 58·03 | 4·30 | 0·82 | 11·545 | 37·29 | 4·23 | 0·83 | 52·406 |
| | 1849. | | | | 1849. | | | | 1849. | | | | 1849. | | | | 1849. | | | |
| Winter . . | 43·9 | 2·72 | 0·73 | 12·259 | 42·84 | 0· | 0· | 14·273 | 37·55 | 1·89 | 0·74 | . . | 41·54 | 2·17 | 0·82 | 1·800 | 41·96 | 2·28 | 0·82 | 8·518 |
| Spring . . | 54·29 | 3·35 | 0·76 | 8·773 | 55·62 | 0· | 0· | 10·573 | 53·96 | 2·56 | 0·61 | 3·669 | 53·01 | 3·27 | 0·77 | 0·890 | 55·04 | 3·62 | 0·82 | 2·368 |
| Summer . | 71·51 | 6·15 | 0·81 | 21·514 | 72·74 | 6·67 | 0·82 | 17·732 | 73·33 | 4·95 | 0·62 | 8·717 | 77·40 | 6·73 | 0·74 | 0·475 | 76·21 | 6·45 | 0·71 | 1·109 |
| Harvest . . | 60·84 | 3·81 | 0·69 | 14·055 | 60·98 | 4·06 | 0·74 | 10·095 | 57·69 | 3·13 | 0·68 | 3·605 | 62·78 | 4·42 | 0·77 | 4·515 | 59·02 | 4·54 | 0·85 | 17·264 |
| Mean . | 57·67 | 3·85 | 0·74 | 56·601 | 58·03 | 0· | 0· | 52·483 | 55·67 | 3·13 | 0·66 | . . | 58·74 | 4·14 | 0·77 | 7·680 | 58·53 | 4·24 | 0·80 | 39·259 |

Note.—The quantities throughout have been reduced to English measures.—Ed.

## Table II.

*Difference between Winter and Summer,* 1848.

| Tiflis. | Redutkale. | Kutais. | Lenkoran. | Baku. | Schusoha. |
|---|---|---|---|---|---|
| 43·54 | 32·38 | 35·37 | 42·55 | 41·54 | |

*Difference between Winter and Summer,* 1849.

| Tiflis. | Redutkale. | Kutais. | Lenkoran. | Baku. | Schusha. |
|---|---|---|---|---|---|
| 35·78 | 27·61 | 29·90 | 34·25 | 35·86 | 35·0 |

*Difference between Winter and Summer,* 1850.

| Tiflis. | Baku. | Aralich. | Alexandropol. |
|---|---|---|---|
| 35·78 | 35·86 | 45·56 | 45·72 |

## Table III.

| Seasons. | Lat. 40° 47′.<br>Alexandropol (1849).<br>4818 feet. | | | | Lat. 39° 42′.<br>Aralich (1849).<br>2598 feet. | | Lat. 40° 10′.<br>Erivan (1844-45).<br>3167 feet. | | Schuscha.<br>3867 feet. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Temperature of the Air. | Humidity Absolute. | Humidity Relative. | Rain and Snow. | Temperature of the Air. | Rain and Snow. | Temperature of the Air. | | Temperature of the Air. | Rain and Snow. |
| Winter . . | 20·30 | . . | 0·86 | 2·237 | 31·56 | 0· | 19·3 | . . | 29·78 | 0· |
| Spring . . . | 42·80 | . . | 0·73 | 5·762 | 54·45 | 0· | 53·4 | . . | 45·50 | 5·171 |
| Summer . . | 66·02 | . . | 0·58 | 5·822 | 77·02 | 1·105 | 76·3 | . . | 64·90 | 9·375 |
| Harvest . . | 47·12 | . . | 0·72 | 3·334 | 52·94 | 0·130 | 57·2 | . . | 48·17 | 3·890 |
| Mean . | 43·88 | . . | 0·72 | 18·094 | 53·90 | . . | 51·6 | . . | 48·17 | . . |

English measures.—ED.

## Table IV.

| Seasons. | Lenkoran.<br>38° 44′ | Palermo.<br>38° 7′ | Montpellier.<br>43° 18′ | Treves.<br>49° 46′ |
|---|---|---|---|---|
| Winter . . | 38·16 | 52·5 | 44·4 | 36·1 |
| Spring . . | 55·9 | 59·0 | 56·6 | 50· |
| Summer . . | 76·8 | 74·3 | 75·9 | 64· |
| Harvest . . | 62·1 | 66·2 | 60·9 | 50·1 |
| Mean . | 57·2 | 62·9 | 59· | 50· |